EFFECTIVE METHODS OF ACCIDENT CONTROL IN SMALL INDUSTRIAL PLANTS

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Jefferson Edward Macon

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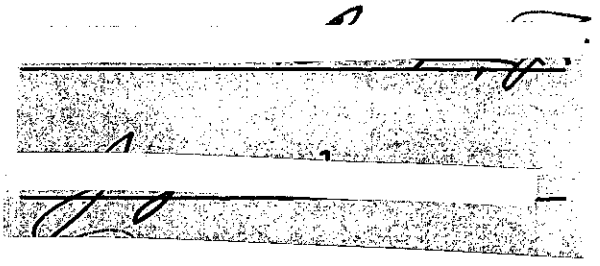

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FOREWORD

The small plant accident problem in American industry is of such tremendous magnitude that the writer was hesitant to undertake a study of it in the limited time available for a master's thesis. A comprehensive study of small plant safety would require the efforts of the nation's leading safety organizations over a period of many years.

An initial survey of the literature indicated that very little significant work has been done in the small plant field. This literature search included not only a study of material in the library of the Georgia Institute of Technology, but also a thorough examination of the small plant material in the National Safety Council library, the most complete safety library in the nation.

Small plant safety has been the subject of periodical articles, conference papers, and other similar publication for many years, but there have been no major publications on small plants prior to this time. In 1951 the National Safety Council published a brochure titled "Safety pays the Smaller Business." This brochure contains excellent promotional material, but provides very little information which will enable small plant management to acquire a comprehensive understanding of accident prevention principlea and practices.

Very few statistical studies have been made of small plant accident rates. Perhaps the best were a study reported in the National Safety Council's Accident Facts in 1949, and a study made by the Bureau of Labor Statistics of the U. S. Department of Labor in 1948. Data

from these studies have been used in this thesis. In 1950 a comprehensive survey was made by the National Association of Manufacturers, but the findings of this study have not been published yet.

The writer was disappointed to learn during his literature search that the American Society of Mechanical Engineers had published in 1950 a book titled Small Plant Management in which every phase of management was thoroughly covered except safety. Entire chapters of this book were devoted to other phases of industrial management, but safety received only a few brief comments scattered through the book.

In view of the apparent lack of material on the subject, the writer made his decision to undertake a study of the small plant problem. It is hoped that the results of the study will be sufficiently enlightening to encourage interested public and private safety agencies to undertake further small plant studies.

EFFECTIVE METHODS OF ACCIDENT CONTROL IN SMALL INDUSTRIAL PLANTS

CHAPTER I

THE SMALL PLANT ACCIDENT PROBLEM

Accidents in small industrial plants inflict a tremendous burden on the economic and social life of the nation. Each year the industrial workers of the United States suffer 16,000 deaths and two million injuries in occupational accidents.[1] The total cost of these accidents is two and one-half billion dollars.[2] These costs include wages lost by disabled workers, loss of future earnings by permanently disabled workers, medical expense, and property damaged and production lost in industrial plants.

Small plants employ a large percentage of the total industrial employees of this country,[3] and the accident rates of small plants are more than double the rates of larger plants.[4] Therefore, small plants and their employees bear most of the burden of the enormous number of occupational accidents which occur in American industry each year.

It is imperative that some means be determined by which small plants can effectively reduce their accident rates. Small plant managements must be convinced that to operate profitably and to be just to their employees, they must control their accidents. And the principles by which the larger plants of the nation have so effectively reduced their accidents must be adapted for practical application by the smaller plants.

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[1] References are listed numerically at the end of each chapter.

Definition of a Small Plant. For purposes of safety organization, industrial plants are usually divided into three size groups: small, 100 or less employees; medium, 101 - 500 employees; large, over 500 employees.

The following definition of a small business was given at the President's Conference on Industrial Safety:[5]

> For purposes of description (rather than of exact definition) small businesses may be considered those which have any of the following characteristics:
> (a) A business which is operating with its own capital, either individually owned or a partnership.
> (b) Any plant having fewer than 100 employees. This number limitation is arbitrary, for a machine shop with 100 employees is small, but a power plant with 100 employees is large.
> (c) A business whose management is essentially a matter of one-man control.

To the workmen's compensation insurance carrier, size of plant or size of risk is defined as the dollar size of the annual compensation premium paid by a plant. This definition takes into account not only the number of employees in a plant but also the accident experience of the particular industry concerned.* This definition of size of risk is important because the assistance which small plants receive from their insurance carriers will be determined to a great extent by the dollar size of their premiums.

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*The premium for workmen's compensation insurance for a given industry is fixed at a certain rate per $100 payroll. This rate is determined by the past accident experience of the industry over a period of several years. Thus, from the insurance carrier's point of view, a cotton mill of several hundred employees with its inherently less hazardous operations might be considered a smaller risk than a foundry of 100 workers with its inherently more hazardous operations.

Statistics on small plants are based for the most part on the under-100-employees definition. This dissertation is directed chiefly to this size group of industrial plants. It is felt, however, that much of the material presented will be of practical value to plants in the medium size group or to any plant not requiring the services of full-time safety personnel.

Small Plant Accident Rates. The smaller industrial plants of the United States have always had higher employee injury rates than the larger plants of the nation. This fact was shown in a study made more than twenty years ago.

TABLE I

INJURY FREQUENCY RATES BY SIZE OF PLANT, 1928*

Number of Employees	Disabling Injuries Per Million Man-Hours
1 - 99	33
100 - 499	36
500 - 999	28
1000 or more	21

*G. G. Grieve, "Large Plants are Safest," National Safety News, 20:107-108, October 1929.

This table covers a study of 1338 plants having an exposure of more than one billion man-hours. A study made in 1948 covering an exposure of more than 13 billion man-hours in 6454 plants reporting to the National Safety Council provides an even more valid picture of the higher

rates of smaller plants.

TABLE II

INJURY FREQUENCY RATES BY SIZE OF PLANT, 1948*

Number of Employees	Disabling Injuries Per Million Man-Hours
Under 100	26
101 - 500	21
Over 500	11

*U.S. Bureau of Labor Standards, Department of Labor, "Report of Committee on Programs and Services," Proceedings, President's Conference on Industrial Safety, March, 1949, p. 170.

Table II shows that the average frequency rate for plants of 101 - 500 employees is almost DOUBLE the rate for plants of over 500 employees. Plants of less than 100 employees have rates MORE THAN DOUBLE those of the over-500-employee plants.

Size Distribution of Manufacturing Plants. The fact that injury rates of smaller plants are extremely high poses a tremendous economic and social problem. The size distribution of manufacturing firms and employment shown in Table III points up the true magnitude of the problem.

TABLE III

SIZE DISTRIBUTION OF MANUFACTURING FIRMS AND EMPLOYMENT, MARCH 31, 1948*

Size Class	Manufacturing Firms		Paid Employees	
	Number	Per Cent	Number	Per Cent
Under 100	310,200	94.2	3,414,000	21.4
100 - 499	15,300	4.6	3,142,000	19.8
500 or over	3,800	1.2	9,283,000	58.6
Total Mfg.	329,300	100.0	15,839,000	100.0

*U.S. Department of Commerce, Business Structure Division, Office of Business Economics, Survey of Current Business, May, 1950, pp. 13, 19, 20.
NOTE: Details will not necessarily add to totals because of rounding.

Table III shows that in 1948 there were in existence in this nation:

1. 325,500 manufacturing plants employing less than 500 workers, and 6,556,000 employees working in these plants. This group includes 98.8% of the total manufacturing plants and 41.2% of the total manufacturing employees.
2. 310,200 plants employing less than 100 workers, and 3,414,000 employees working in these plants. This group includes 94.2% of the total manufacturing plants and 21.4% of the total manufacturing employees.

Cost of Accidents to Small Plants. It is estimated that the annual cost to industry of occupational injuries is two and one-half billion dollars.[6] Since the injury rates of smaller plants are more than

double those of larger plants, and since smaller plants employ such a large percentage of the nation's industrial workers, the small plants pay a major share of this staggering cost.

In addition, the workers in smaller plants suffer most of the annual industrial toll of 16,000 deaths and 2 million disabling injuries.

An excellent illustration of the tremendous cost to small plants of occupational accidents is found in a recent study made in California. This study showed that of an annual industrial accident cost in that state of 230 million dollars, small plants pay 173 million dollars, or more than 75% of the total costs.[7]

The preceding cost figures include both insured and uninsured costs of accidents. Since the uninsured - or indirect - costs are not always fully recognized, it is well to compare the insured - or direct - accident costs of small and large plants. These costs include wage and medical payments to injured workers, the costs covered by workmen's compensation insurance.

The cost of compensation insurance to small risks, or small plants, is considerably greater than to larger risks. This is a matter of simple economic necessity. The loss ratios* of smaller risks are greater than the loss ratios of larger risks. A study made of manufacturing risks in the State of Georgia showed the average loss ratio of 1467 risks of less than $300 annual premium size to be 17% greater than the average loss ratio of 1350 risks of more than $300 annual premium size.[8] Because of this difference in loss ratios, a flat added charge

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*Loss ratio is the ratio of compensation insurance losses to amount of premium paid.

of $10 to $15 is made in some states on all risks in the smaller size group.

Another factor in the cost of small plant compensation cost is that risks below a certain premium size do not get the benefit of experience rating.* Therefore, the only way a small plant can get a lower rate is for the manual rate for the entire industry to be lowered. Since the large plants have already lowered their accident rates and loss ratios substantially, the only way for the manual rate of a given industry to be reduced materially is for the small plants to reduce their accident rates.

Causes of Higher Small Plant Rates. The question of why employee injury rates are higher in small plants than in large, can be divided into two parts. First, why are many small plants doing little or nothing about employee injuries? Second, why are those small plants which have undertaken some accident control measures less successful in reducing their injury rates than larger plants?

1. Why have many small plants done little or nothing to prevent employee injuries? The chief reason for this is that most small plant managements do not realize the seriousness of their accident problems. Those plants that do take some cognizance of the problem feel that by carrying workmen's compensation insurance they have protected themselves

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*Compensation insurance rates are based on a uniform or manual rate for each industry, according to the past accident experience of the industry. The large risks in each industry are experience rated, an arrangement by which their insurance rates are reduced below manual rates if their accident and loss experience is better than the industry average over a period of time.

from economic loss and have discharged their obligations to their employees.

Many small plants fail to recognize their accident problems because of the small number of injuries which their employees incur in a given time. For instance, in a sheet metal shop employing 25 workers, an average of one disabling injury a year would not seem to the management of that shop to be a bad accident experience. On a man-hours basis, however, this plant would have a frequency rate of 20 disabling injuries per million man-hours,* more than double the national average rate of 8.8 for the sheet metal industry.[9]

A chemical plant employing 50 workers and having only two disabling injuries per year would have an injury rate of almost four times the national average rate of 5.7 for the chemical industry.[10] A textile plant employing 100 workers and having four injuries a year would have a rate almost three times the average rate of 7.9 for the textile industry.[11]

To measure its accident experience properly, the small plant must calculate its injury rate on a man-hours basis rather than consider only its number of injuries in a given time. Few small plants calculate such rates, however, and many plants do not even keep records of their accidents.

Many small plants are as unaware of their economic loss from accidents as they are of their high accident rates. Small plant managers feel that the premiums paid for workmen's compensation insurance cover their entire accident cost, but insurance covers only the direct costs

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*Based on a work-year of 2000 hours per worker.

of accidents and offers no protection against the much greater indirect costs.

In a study made by Heinrich some years ago, it was shown that the uninsured or indirect costs of accidents were, on the average, four times greater than the insured or direct costs.[12] Insured costs include medical expense and compensation payments made to injured workers. Uninsured costs, all of which are paid by the employer, include damage to material and equipment, loss of production of damaged equipment, time lost by supervisors and other workers, cost of training replacements for injured workers, and other similar costs.

Heinrich's study showed that the average insured cost of disabling industrial accidents was about $200 and the uninsured cost about $800. The total cost of a single such accident would be a severe loss to a plant employing 25 workers. The payroll of such a plant, assuming a 2000-hour work year and a $1.00 per hour average wage, would be $50,000 a year. A single disabling accident costing a total of $1,000 for both direct and indirect expenses would cause a loss equal to two per cent of the annual payroll; two accidents in a single year would cause a loss equal to four per cent of the payroll. Such losses cut deeply into the profits of small plants, many of which may be operating on close profit margins.

Loss from property damage may be disastrous in a small plant. While accidental damage to a single machine in a large plant would cause little interruption to production, it might completely stop production in a small plant which would likely have only one or two of that type of machine. In a small plant it is also more difficult to replace skilled

workers who are injured in accidents. Small plants usually have no reserve of trained workers such as many large plants do.

Two definite conclusions may be drawn concerning those small plants that do nothing about accident control. First, even though the number of accidents may be small, there may still exist a serious accident problem. Second, even though a plant may carry compensation insurance, it is protected only from the direct cost of industrial accidents.

2. Why have those plants which have undertaken some accident control measures not made as much progress as large plants? Compared to the safety programs of large plants, there are many weaknesses in the programs of small plants. In many small plants, even though some safety activities may be carried on, no one person will be assigned to safety and no specific person will be given the responsibility for accident prevention. In a recent survey of 154 small plants, it was found that in only 74 plants was safety assigned to some one person.[13] No industrial program can be effective unless someone is made accountable for that program.

Very few small plants employ trained safety personnel to direct their safety programs. Of the 154 small plants studied, only two employed trained safety men. The lack of direction and guidance by someone with training in the field of accident prevention is a major weakness of small plant programs.

Accident control in most small plants is assigned as a part-time duty of someone already a member of the plant organization. Safety is usually incidental to the other duties of such persons and is frequently

neglected when other problems arise. Even when adequate time and effort are given to safety, many small plant programs are incomplete or unbalanced.

It is an accepted fact that for maximum effectiveness, an accident control program should include each of several specific activities. There is information available from insurance companies and safety councils which sets forth the elements of safety programs, but much of this material is designed for use by large plant safety specialists. Most of this material is written in the language of the professional safety man, not in the language of the average owner-manager of a small shop employing 30 or 40 workers.

Part-time safety personnel in small plants, because of their lack of a comprehensive understanding of the accident control problem, usually select one or two activities for the basis of their safety programs and over-emphasize these to the neglect of other equally essential activities. There is a popular belief in many plants that the secret of good safety is to stimulate interest in safety among the work force. There are numerous contests and awards, and no end of emotional appeals made to the workers. The feeling in these plants is that if sufficient interest is developed, little more need be done.

Another element of accident control which is frequently over-emphasized to the neglect of others is mechanical safeguarding. Many plants devote all their efforts to guarding the physical hazards of the workplace and completely overlook the human factors of safety. Human failures are responsible for just as many accidents as mechanical failures are. According to the National Safety Council, in 20% of all occupational accidents, human failure is the major cause; in 20%, mechanical

failure is the major cause; and in the remaining 60%, the cause is a combination of human and mechanical failure.[14] (See note below)

Even the most complete small plant programs usually consist only of stimulating interest and of safeguarding machines and equipment. Such important elements as selective employment and placement of workers, and training in safe methods of work are often neglected. Medical facilities for treating injuries are either very limited or non-existent. Of 154 small plants studied, 73% made regular inspections to detect safety hazards, and 78% used some means of stimulating interest in safety. Of these plants, however, only 16% required pre-employment physical examinations. Only 27% of the plants gave safety training to foremen, and only 47% gave safety training to workers.

A pre-employment physical examination is the absolute minimum for employment of safe, productive workers. Some type of mental screening, however simple it may be, is also needed to ensure proper selection and placement of industrial workers.

Safety training, for both foremen and workers, is also essential for maximum effectiveness in accident prevention. A study made over a period of years in a plant employing 600 workers indicates the value of safety training. According to the author of the report from which the data in Table IV was taken, all safety factors in this plant other than training remained very nearly constant.

NOTE: The percentages used here are rounded for simplicity.

TABLE IV

VALUE OF SAFETY TRAINING*

Year	Type of Safety Activities	Number of Disabling Injuries
1926	None	279
1927	Safety training for foremen	156
1928	Safety training for all employees	20
1929	" " " " "	10
1930	" " " " "	4
1931	" " " " "	1
1932	" " " " "	1

*A. D. Lynch, "What Can a Small Plant Do?" National Safety News, 27:27, March, 1933.

The lack of proper medical facilities is a real hindrance to the reduction of small plant accident rates. Large plants have extensive medical facilities on their premises with adequate medical personnel available to treat their employees. A worker suffering a minor injury can receive all necessary medical treatment without having to leave the plant, and hence the injury is not classified as disabling. In a small plant, however, a worker with the same injury would have to be sent to an outside doctor, not only for initial treatment but also for observation and retreatment. This frequently results in the loss of one or more days from work and the injury must be classified as disabling.

This indicates that the difference in injury rates between large and small plants may not be due entirely to differences in numbers of

accidents but also to differences in injury treatment facilities. A study made by the National Safety Council bears this out.[15] Among 4000 plants in selected industries, plants of under 500 employees had a smaller average number of days lost per temporary total disability than plants of over 500 employees. This is a direct result of the higher proportion of one- and two-day disabling injuries in the smaller plants. The rates of the small plants were double those of the large plants in the study.

The conclusions to be drawn concerning the smaller plants whose safety programs are not as successful as those of large plants are: first, that they suffer the lack of direction and guidance by trained safety personnel; and, second, that they lack adequate medical facilities to prevent minor injuries from becoming disabling.

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13. J. E. Macon, Effective Control of Accidents in Small Industrial Plants. Unpublished Master's thesis, Georgia Institute of Technology, 1951, p. 28.

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CHAPTER II

BASIC ELEMENTS OF ACCIDENT CONTROL

The phrase accident control program, or more commonly, safety program, conveys vastly different meanings to different individuals. To many it means an elaborate, cumbersome, and unwieldy program which is different from all other industrial activities. To many persons, safety is an intangible sort of thing they "just can't seem to get their teeth into."

Actually, the very opposite is true. The principles of accident control are simple, and the elements of accident prevention are very much like the elements of other industrial activities. That this is true can be proved by a few logical steps of reasoning.

The aims of accident control should first be established. It is self-evident that the first purpose of a safety program is to prevent accidents to persons and property. It is inevitable, however, that preventive measures will sometimes be inadequate and that accidents will occur. The second aim of a safety program is then to minimize the results of accidents and to learn from them something which might be used to avoid the recurrence of similar accidents. A program of accident control can thus be thought of as those activities which are carried on BEFORE the accident occurs and those steps which are taken AFTER the occurrence of the accident.

Before the Accident Occurs. In safety, as in production, industry works chiefly with three things: MEN, MATERIALS, and MACHINES. The problem then is to determine what controls must be exerted over these three

things to prevent accidents which may cause injury to the men and damage to the machines and materials. This can best be done by reasoning what must be done to prevent one single accident. To prevent an industrial accident:

1. The machines and materials used by the worker must be made safe to work with. The hazards of his machines and materials must be brought within acceptable standards of control.
2. The worker must be physically and mentally capable of safely performing the job to which he is assigned. He must have adequate strength, vision, height, reach, and other physical traits; and he must be sufficiently intelligent to follow instructions and to learn to perform his job safely.
3. The worker must know how to work safely at the job to which he is assigned. He must be taught the safe methods of performing his particular job.
4. The worker must want to work safely. He must be sufficiently interested in safety to guard himself from personal injury.

Except for the two per cent which are said to be unavoidable,[1] industrial accidents will be prevented if these four conditions are met. If one or more of these conditions is not met, the occurrence of an accident will always be possible in any industrial situation.

After the Accident Occurs. Several steps must be taken after the occurrence of an industrial accident:

1. The injured worker must be given proper medical care. Prompt medical attention minimizes the severity of injuries.
2. The accident must be investigated, and a record made of it. Proper investigation and recording of accidents provides information valuable in the prevention of similar accidents.

Excluding those preventive measures which result from accident investigation, the cycle of any single accident has now been completed.

The Six Basic Elements of Accident Control. The activities which are carried on before an accident occurs and the steps which are taken after an accident occurs have now been established. Based on these things, the following are proposed as the six basic elements of industrial accident control:

1. Control of accident and health hazards.
2. Selective employment and placement of personnel.
3. Safety training for all personnel.
4. Stimulation of interest in safety.
5. Medical care for injured persons.
6. Investigation and recording of accidents.

The order in which these elements are presented is chosen because it offers a logical pattern of reasoning which will enable management to understand the fundamental principles of accident control.

It is realized that a complete division between these elements does not exist. There is considerable overlap between some of them, particularly between interest stimulation and training. Certain safety

training activities will cause a stimulation of greater interest. Some types of interest stimulation may carry over into the field of safety training. In spite of such overlaps, each of the six basic elements is, for the most part, a separate field of activity having a separate and distinct purpose.

Using these elements as a foundation, any plant in any industry can develop an effective accident control program. All that is necessary is that the management of a plant determine the degree of emphasis to be placed on each of the elements. In one industry it may be possible to control the physical hazards of materials and equipment to such an extent that very little training is needed. The materials and equipment of another industry may have certain inherent hazards which are difficult to control adequately; in such cases training assumes greater importance. In still other instances such things as a low wage scale or a short labor market may limit the possibilities of selective employment of workers. Such a limitation on one element will require a greater emphasis on one or more of the other elements. Still further, the types and severity of injuries in one industry may require different and more extensive medical facilities than those needed in another industry experiencing dissimilar types of injuries.

Numerous other illustrations could be presented, but the preceding should be sufficient to convince management that every accident control program must be individually designed for a specific plant having its own particular set of conditions. Even though the elements of accident control are basically the same for all industrial plants, large or small, there are significant differences between plants and between industries in the

degree of emphasis placed on individual elements and the methods used to achieve the aims of these elements.

It may be argued that the six elements here presented do not include all the ingredients which are necessary for effective accident control. Numerous outlines for safety programs can be found that suggest ten or more steps which should be taken to organize a program. Such packaged outlines or plans seldom attempt to reduce accident control to fundamentals. They offer no pattern of reasoning to enable management to understand the basic principles of industrial safety. It is felt that the six elements of safety which are presented here do provide such a pattern. It is further felt that the numerous steps in safety proposed by various organizations are but subdivisions of these six basic elements.

If effective accident control is to be widely accomplished in industry, especially in smaller industry where there has been less contact with the safety movement, there must be made available a logical pattern of reasoning by which industrial management can determine for itself the measures by which it can be accomplished.

Discussion of the Basic Elements. In order that there be a thorough understanding of the six elements of accident control, the following explanation of each is given.

Control of Accident and Health Hazards. Hazard control is the control of all physical and mechanical conditions of machines, materials, buildings, and equipment which might contribute to the occurrence of an accident or which might be the cause of damage to the health of workers. Such control can be accomplished by the proper selection, arrangement, use, and maintenance of buildings, equipment, tools, and vehicles.

There must be, also, proper selection, handling, placement, and processing of materials, to eliminate unnecessary or hazardous handling, interference with operations, and hazards from improper storage. Where the materials used are injurious to health, the processes should be so enclosed or isolated that workers are exposed to minimum hazards.

After the working conditions are made safe, a continuous effort must be made to keep them safe. Regular inspections must be made to detect and correct any conditions which might become hazardous.

Hazard control is a responsibility of all levels of plant personnel. Workers should report all hazards observed to their supervisors. Supervisors should seek to determine the hazards of their departments and should give prompt attention to hazards reported to them by their workers. Plant managers should provide the means necessary to control the hazards reported by workers and supervisors. Managers should also make periodic inspections of their plants to see that safe workplaces are maintained for their workers.

If any one element of accident control can be said to be of first importance, it is hazard control. Not only is control of the hazards of the work environment important for its own sake but also because the workplace must be made safe before management can expect to secure the cooperation and stimulate the interest of the workers. For instance, it would be extremely difficult to create worker interest if workers could see around them hazardous machines which were unguarded. Safety training would also be difficult to carry on effectively so long as working conditions remained unsafe.

Selective Employment and Placement of Personnel. A safe industrial worker must be both physically and mentally capable of safely performing the job to which he is assigned. New workers should always be given pre-employment physical examinations by competent physicians. New workers should also be screened for their mental and emotional qualifications. Such screening need not be elaborate or complicated, but an effort should be made to screen out those prospective employees who cannot be placed in jobs which they are capable of performing safely. This does not mean that they must already know how to do a job, but that they must be capable of learning to do the prospective job safely.

The requirements of proper placement of personnel apply also to old* employees who are placed on new or different jobs. Their qualifications should be rechecked before they start work on a new job.

All old employees should also be given periodic reexaminations to see that they remain in safe physical condition. The frequency of such reexaminations will be determined by the age and occupation of individual workers.

Safety Training for all Personnel. To prevent industrial accidents, every person in the plant must have certain knowledge or information concerning accident prevention principles and practices.

The know-how of safety must start at the top level of the plant. Plant management must have sufficient information concerning accident control to make decisions concerning general policies of the safety program.

The plant supervisory group must have the knowledge necessary for

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*Old in point of service.

policy making within individual departments. More important, supervisors must have a considerable knowledge of accident prevention techniques and of methods of teaching safety to their workers.

The working group itself must have a thorough knowledge of accident prevention principles and of the safe methods of performing their various tasks. No matter how much a worker might want to work safely, he is still very likely to have an accident if he does not also know how to work safely.

In addition to having full knowledge concerning accident prevention, supervisors and workers must have certain information about treatment of injuries. They must have sufficient knowledge of first-aid methods to administer emergency treatment to seriously injured persons. They must be sufficiently aware of the dangers of infection that all minor injuries will be reported and properly treated. An added factor in first-aid training is that such training considerably increases the safety consciousness of workers.

There must be, therefore, a considerable amount of training in an accident control program in order for each personnel group to have the knowledge or information it needs to successfully carry out its respective functions in the program.

Stimulation of Interest in Safety. It is necessary that interest in safety be stimulated because of the attitude the average person has toward accidents. The majority of industrial workers take the attitude that accidents always happen to someone else. The attitude also prevails among some workers that if they work in industry for a considerable time, it is impossible to avoid being hurt eventually. This attitude is parti-

cularly prevalent among the more hazardous industries such as wood products, where there is a high incidence of finger and hand amputations from contact with saws.

It is not sufficient, however, that only the workers be interested in accident control. It is more proper to say that the workers in an industrial plant will have very little interest if there is not appropriate interest taken in safety by the management and the supervisors of the plant.

If those persons at the top level of plant management do not sincerely desire to control accidents in their plant, there will be no genuine interest in safety among their supervisory personnel. If the supervisors do not have an active interest, they will never be able to develop real interest among their workers.

Because of the different functions of the various levels of plant personnel, the interest in safety at each level will be somewhat different in nature.

Top management interest should be in the form of leadership and support. If a manager expects to control accidents in his plant, he must issue orders to that effect to be carried down through his organization. He must support those persons charged with the responsibility of carrying out his orders by giving them sufficient authority to prosecute effectively the accident control program.

The interest of the supervisory group must be partly that of leadership and partly that of seeking at all times to provide safer working conditions for their workers. They must stimulate interest among their workers; they must set an example in safe methods of work. Super-

visors bear the major responsibility for accident control; to carry out their functions properly in a program, their interest must be high.

The safety interest of the workers in a plant should be that of protecting themselves and their fellow workers from injury. It is not sufficient that a worker seek only to protect himself; he is responsible also for the safety of his fellow workers.

Medical Care for Injured Persons. For legal as well as moral reasons, every plant must provide adequate facilities for medical care of workers who may be injured in the plant. Several people in every plant should be trained to administer emergency treatment which might be required before a seriously injured person could be moved to the plant first-aid station. This emergency treatment includes such things as stoppage of severe bleeding, inducing breathing when it has stopped, and the immobilizing of fractured limbs.

An adequate first-aid station with a trained attendant working under instructions from a physician should be provided in the plant for treatment of minor injuries. Prompt first-aid treatment prevents minor injuries from becoming serious, and minimizes the effects of serious injuries.

Arrangements should be made also to have a competent physician treat all serious injuries to plant employees.

Investigation and Recording of Accidents. When prevention fails and an accident does occur, the accident must be investigated and a record must be made of it. In the first place, almost every state requires that any injury requiring attention by a physician be reported to a state agency. Certain facts about the accident and the circumstances surround-

ing it are necessary to provide the information required by these agencies.

In addition to the legal requirements of state agencies, there are other even more important reasons for investigating and recording accidents. By proper analysis of accident records, the reasons for industrial accidents can be determined and methods can be devised for preventing recurrence of the same or similar types of accidents. Certain trends or patterns may be discovered from analysis of accident records maintained over a period of time. Accident records also provide a means of calculating accident rates which give a measure of the safety performance of a given plant as compared with its own previous performance or with the performance of other similar plants.

Accident investigations and reports need not be unwieldy or complicated. Very simple systems can be devised, and some practical method of investigating and recording accidents is a necessary element of an effective industrial accident control program.

REFERENCES

1. H. W. Heinrich, Industrial Accident Prevention. New York: McGraw-Hill Book Company, Inc., 1950. p. 17.

CHAPTER III

SURVEY OF ACCIDENT CONTROL METHODS

To determine the methods of accident control now being used in small plants, the writer conducted a questionnaire survey of 1004 plants of under 100 employees in Georgia, North Carolina, and Ohio. To determine the differences between the accident control methods used by large and small plants, the same questionnaire survey was made of 1096 plants of over 100 employees in the same area. Questionnaires were returned by 154 of the smaller plants and by 214 of the larger plants.

Table V gives a breakdown of the questionnaire distribution and return.

TABLE V

QUESTIONNAIRE DISTRIBUTION AND RETURN

State	Plant Size	Questionnaires Distributed	Questionnaires Returned	Per Cent Return
Georgia	Under 100	682	73	11%
	Over 100	418	42	10%
North Carolina	Under 100	125	34	27%
	Over 100	375	133	35%
Ohio	Under 100	197	47	24%
	Over 100	303	39	13%
Total	Under 100	1004	154	15%
	Over 100	1096	214	20%

The questionnaire used in this survey (See Appendix) was designed to secure information of three types:

1. Injury frequency rates.
2. Personnel employed to conduct safety programs.
3. Activities of which safety programs are composed.

Injury Frequency Rates. The frequency rate of the 154 small plants returning questionnaires was 24 injuries per million man-hours. The frequency rate of the 214 larger plants was 12 injuries per million man-hours. The small plant sample covered an exposure of 12 million man-hours worked in 1950; the large plant sample covered an exposure of 418 million man-hours worked in the same period.

It is interesting to note that these rates compare closely with those which the National Safety Council calculates on a national scale. With the survey rates, as with the national rates, the small plant frequency rate is DOUBLE the rate of the larger plants.

Since there is a decided difference between the accident rates of the small and large plants in this study, a comparison of the safety personnel and safety activities of the two sizes of plants should indicate the weaknesses of current small plant accident control methods. Although the samples used in the study are not sufficiently large to indicate exact degrees of weakness, it is felt that the data obtained are sufficiently reliable to suggest a definite pattern of weakness in small plant programs.

Safety Personnel. Of the 154 plants of under 100 employees, only 47% had some one person regularly assigned to safety. Of the 214 plants

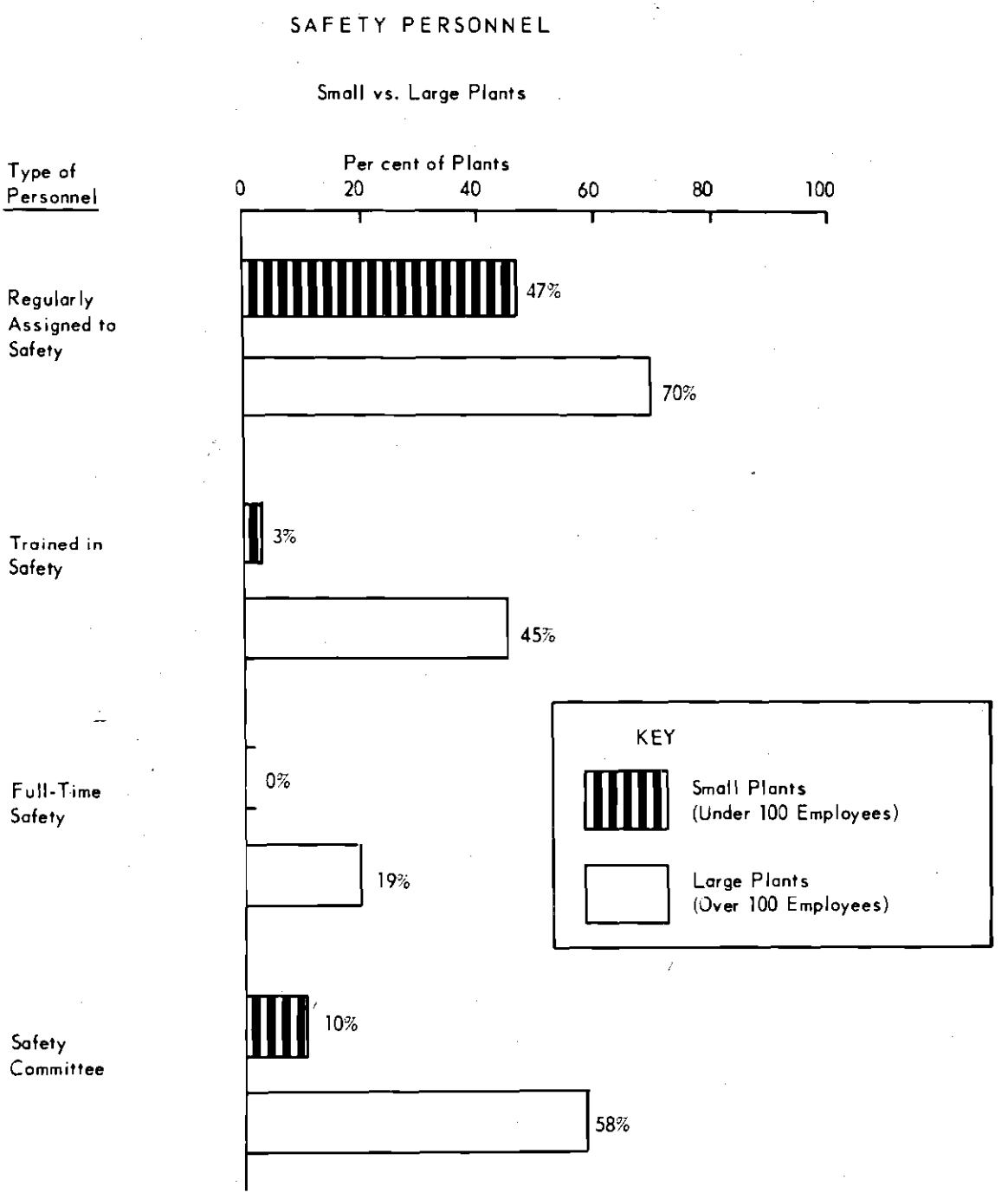

Figure 1

(From Effective Methods of Accident Control in Small Industrial Plants by J.E. Macon, Georgia Institute of Technology Library, Atlanta, 1951.)

of over 100 employees, 70% had someone regularly assigned to safety. Of these plants having someone assigned to safety, only 3% of the smaller plants employed trained safety men, while 45% of the larger plants employed trained safety men. Safety was a full-time assignment in none of the small plants but was a full-time assignment in 19% of the larger plants. Safety committees were used in only 10% of the smaller plants but were used in 58% of the larger plants.

These data support the statement made in Chapter I that the lack of trained safety personnel is a factor in the higher accident rates of small plants. It would not be expected that many plants of under 100 employees would require full-time safety personnel. Since only 19% of the over-100-employee plants used full-time safety men, this cannot be considered a major factor in the difference between small and large plant rates.

The difference in the percentage of plants using safety committees was considerable, however. Although extremely small plants may not need safety committees, there are definite benefits from committee activity which more small plants might well make use of.

A graphic comparison of the safety personnel used in small and large plants can be seen in Figure I.

Safety Activities. Only small differences were found in the hazard control activity of small and large plants participating in this study. Regular inspections to deterct accident hazards were made in 73% of the under-100-employee plants and in 85% of the over-100-employee plants.

A weakness was discovered in the employment practices of both

small and large plants, the greater weakness being in the smaller plants, however. Pre-employment physical examinations were required in only 16% of the under-100-employee plants and in only 48% of the over-100-employee plants.

Significant differences were noted in the safety training activities of the two size-groups. Safety training was provided for foremen in only 27% of the small plants, while training was provided for foremen in 60% of the larger plants. Safety training was given to workers in 47% of the small plants and in 73% of the larger plants. These data show that there is a lack of safety training in both large and small plants, the greater lack being in the small plants. Since more workers receive training than foremen, it can be concluded that in many cases, workers are being trained by foremen who themselves have had no training.

Not too great a difference was found in the number of plants employing some method of stimulating interest in safety. Some method of interest stimulation was used in 78% of the smaller plants and in 96% of the larger plants. These methods included the use of posters, films, contests, awards, and suggestion systems.

Definite weaknesses were found in the medical care provided for treatment of minor injuries in the plant. In-plant treatment was provided in 74% of the small plants and in 93% of the large plants. Trained personnel administered this treatment in only 48% of the small plants, while treatment was administered by trained personnel in 84% of the large plants. Personnel administering in-plant treatment in small plants were: part-time doctor, 10%; part-time nurse, 1%; trained first-

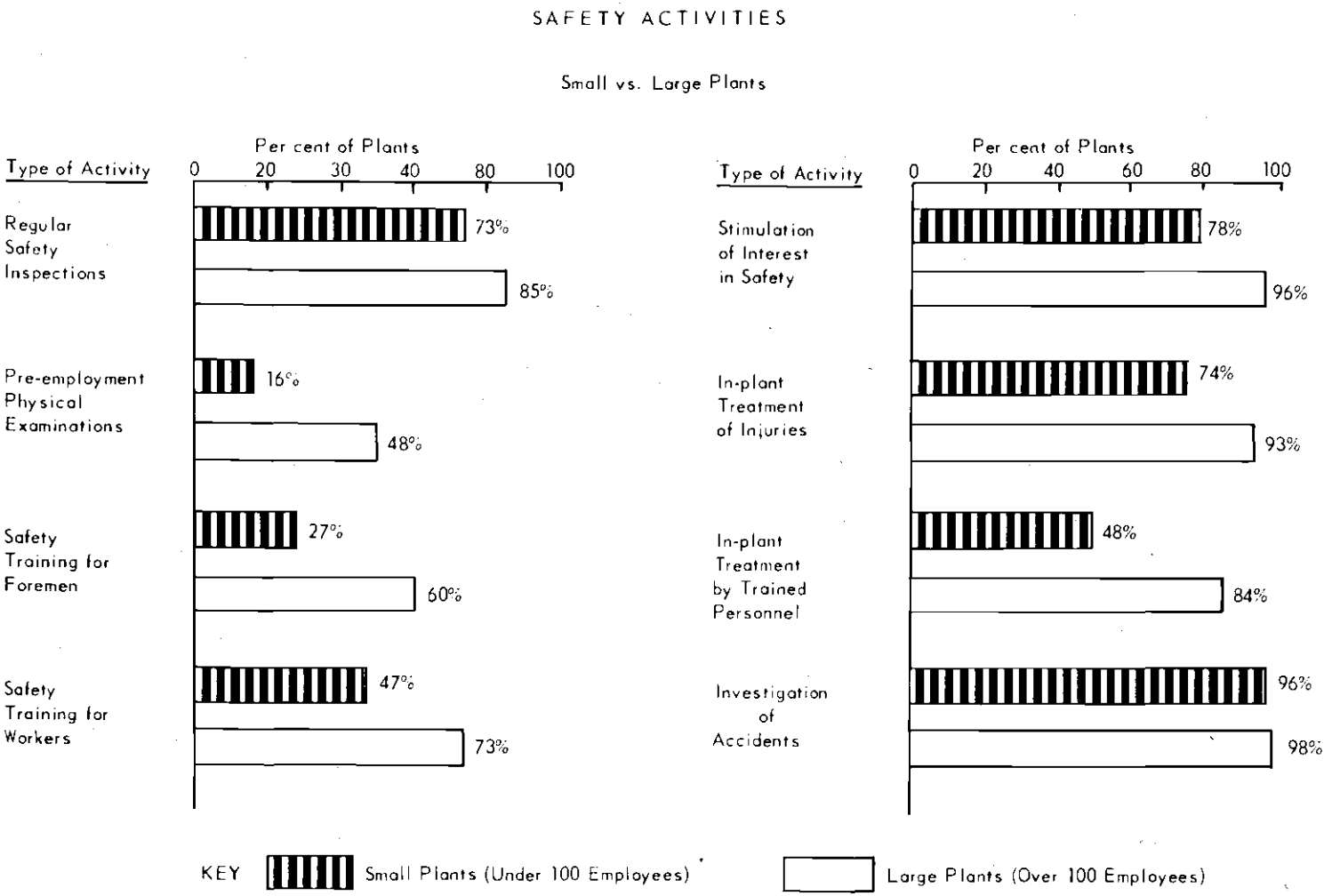

Figure 2

(From Effective Methods of Accident Control in Small Industrial Plants by J.E. Macon, Georgia Institute of Technology Library, Atlanta, 1951.)

aider, 44%; other,* 26%; no one, 26%. Injury treatment personnel in large plants were: part-time or full-time doctor, 17%; part-time or full-time nurse, 27%; trained first-aider, 61%; other, 9%; no one, 7%.

Some type of accident investigation was carried on in 96% of the small plants and in 98% of the large plants. Investigations were conducted by trained safety men in only 1% of the under-100-employee plants, by safety committees in 4%, by executives in 55%, and by foremen in 55%, and by insurance men in 36%. Accidents were investigated by trained safety men in 32% of the over-100-employee plants, by safety committees in 23%, by executives in 32%, by foremen in 68%, and by insurance men in 24%.

Investigation and subsequent analysis of accidents provide considerable information which can be used to prevent future accidents. Proper investigation and analysis require training, however, and the fact that so few small plants employ trained safety men suggests that fewer preventive measures result from accident investigation in small plants.

The major weaknesses in the safety activities of small plants appear to be in the elements of employment and placement of workers, safety training, injury treatment, and accident investigation. Practical methods must be devised by which these elements of accident control can be strengthened in small plants.

The differences in the safety activities of small and large plants can be seen graphically in Figure II.

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*Includes foremen, office workers, timekeepers, and other untrained persons.

CHAPTER IV

SMALL PLANT ACCIDENT CONTROL METHODS

A definition of a method of accident control should now be established. Every industrial program is made up of two parts: 1) the activities of which the program consists, and 2) the organization of persons responsible for carrying on these activities. For purposes of this dissertation, a method of accident control shall be defined as the combination of persons and activities employed by a plant to carry on its program of industrial accident control.

The methods of accident control available to large plants are unlimited. Their safety departments are staffed with personnel trained in all phases of safety activity. There is usually a safety director at staff level to formulate and guide the overall policies of the plant's safety program. There are safety engineers, safety supervisors, or safety inspectors to carry out these policies.

In large plants, other departments may carry on some of the activities necessary to successful accident control. There are engineering departments to design machine guards and other protective devices. There are methods departments to assist the safety department in determining safe job methods. A general training department may have instructors who are expert in the field of safety training. Always there is an employment office whose function is to recruit and hire workers who will be both efficient and safe. There will usually be a well-staffed medical department to give pre-employment physical examinations, to give medical care to injured workers, and to carry on a program of preventive

health measures.

In addition to this vast supply of trained personnel within the plant, there will be available to the large plant considerable assistance from insurance carriers and from various other private and public safety agencies.

But the small plant does not have in its organization these specialized departments with their personnel trained in all phases of safety activity. Nor is there available to the small plant as much assistance from insurance carriers and other safety agencies.

A small shop of 25 employees may be composed of the owner-manager, a bookkeeper, a clerk-typist and two or three foremen with five to eight workers in each of their departments. The owner-manager may be a former department head or supervisor of a large plant who subsequently went into business for himself. Or he may be a craftsman who spent his nights and weekends in a backyard shop that gradually developed into a full-time business. His knowledge of management principles and practices is confined to what he has learned through his own experience.

The typical small shop has no one regularly assigned to safety. The owner-manager probably corrects the more serious hazards pointed out to him by the insurance company engineer, but beyond this there is little hazard-control effort made. The "boss" does all the hiring, selecting workers on the basis of his past experience and personal judgement, with in most cases no pre-employment physical examination being required. To stimulate interest there may be a few "Safety First" signs around the plant and several posters on the bulletin board. Safety training will consist of an occasional "don't get your hand in that gear, Joe," or

"be careful men, we don't want anybody to get hurt" from the foremen. To treat minor injuries the shop probably has a small first-aid kit with, at best, one man in the plant who has taken a first-aid course. There would perhaps be three or four serious injuries a year, and all these cases would be sent to a private doctor or hospital for treatment.

The typical plant of 50 to 100 workers will make a slightly better overall safety effort than the 25-worker shop. The management is likely to be of higher caliber; there may be some specialization of departments; safety may be a part-time duty of someone on the staff; a certain amount of informal training may be done; and a doctor may come into the plant for a short time once or twice a week.

In determining the most effective methods of accident control for small plants, any consideration of the effectiveness of complete safety programs would produce results which would not be suitable for application to all sizes and to all types of industrial plants. Conclusions reached concerning whole programs would be of little value for general application of the individual elements going into those programs. Only a portion of a program which is effective in a given plant will be suitable for use in a plant of a different size or in a different industry. Therefore, primary consideration will be given to methods by which each of the six basic elements might be carried on individually.

In considering the individual elements, emphasis will be given to the individuals or groups both within and without the small plant organization who might effectively help to carry out each element. After a full treatment has been made of individual elements, model programs of accident control will be outlined for plants of under 50 employees and

for plants of 50 - 100 employees, giving both the recommended safety organizations and the activities of which the programs should be composed. Each of these programs can be modified to fit plants which may be slightly larger or smaller.

Hazard Control. Control of accident and health hazards may, in some cases be a matter of the application of simple common sense by plant personnel, and in other cases may require the attention of experts in various fields of engineering or industrial health and hygiene. For example, the need for a guard for an exposed gear of a machine may be detected by any employee of a plant, and a guard to control this hazard may usually be constructed by the plant mechanic. But detection of a hazard created by an unknown concentration of chemical fumes or industrial dusts may require scientific analysis by a qualified engineer or industrial hygienist. Control of such hazards may require the services of ventilation or equipment engineers.

There are several people within a small plant organization who can contribute to effective hazard control. Taking the lead, of course, should be the top executive, who can make periodic inspections to see that his plant is being maintained in safe condition. If safety is assigned to someone on the staff, this person should set up a simple but regular system of inspection and correction of unsafe conditions in the plant.

In many plants there will be need for a safety committee composed of foremen or of foremen and workers. Inspections for unsafe conditions can be made one of the functions of such committees.

Supervisors bear the major responsibility for hazard control. Supervisors are the only representatives of management who are in constant

contact with the materials and equipment of their departments. They are in a position to detect unsafe physical or mechanical conditions as soon as they develop, and supervisors can usually take immediate action to correct or control these conditions. Foremen can also instruct their workers to report all hazards they observe.

Maintenance mechanics also play a large part in controlling accident hazards. In many small plants there is no engineer to design guards and protective devices. This duty falls on the maintenance mechanics, who, if properly supervised, can design and construct adequate protective devices. Maintenance men can also, in the course of their regular preventive maintenance, detect signs of equipment wear or damage that might lead to an accident.

The persons responsible for purchase of material and equipment for building construction and for layout of machines and equipment can also do much to control hazards and provide safe working conditions. These persons can see that new equipment has guards built in by the manufacturer; that buildings are designed to give adequate ventilation, lighting and exits; and that materials and equipment are so arranged that there is adequate work space for operators, adequate aisle space for plant traffic, and efficient storage and processing of materials to eliminate unnecessary or hazardous handling.

If the management of a small plant really wants to control the mechanical and physical hazards of the plant, it can get some assistance from several private and public safety agencies. Most valuable assistance will come from the plant's own compensation insurance carrier. An insurance company engineer will in most cases make an inspection of the plant

before the company will insure the plant. The value of this initial inspection will depend on the attitude of the plant management. If the management demonstrates that it genuinely desires to control the hazards of its plant, the insurance engineer can and will provide the information needed by management. If management shows little interest, the engineer likely will merely make a cursory check to determine whether or not the plant is a good risk, that is, whether the layout and equipment of the plant are sufficiently safe that the insurance company can expect to make a profit. Many plants will be refused compensation coverage on the basis of this initial inspection, unless the management demonstrates its willingness to improve conditions sufficiently to put the plant in the good risk category.

Assuming that management does show interest, how much help can the small plant expect from the insurance company? Many small plants have depended entirely on their insurance engineers for hazard control, but it can easily be shown that this is not sufficient.

Although initial inspections are made by almost all insurance companies before a risk is accepted, subsequent inspections are dependent upon the dollar size of the plant's annual premium. If its annual premium is less than about $600, a plant is said to be a non-serviceable risk. That is, the insurance company usually cannot afford to send its engineers out to service or inspect a plant beyond the initial inspection and annual reinspection on the renewal date of the policy. Loss ratios in small plants average more than 50% of the premium paid for compensation insurance, and all administrative expenses, engineering service, and profits of the insurance company must come from the remainder of the

premium. It is common knowledge in the casualty insurance field that most insurance companies spend less than 3% of the premium dollar on engineering service of their risks. It is economically impossible, therefore, for the compensation insurance carrier to inspect very small risks more than once a year, and this is not sufficient to maintain a proper program of hazard control. An annual visit by the insurance engineer cannot ensure that machine guards will be used, that they will be maintained in safe condition, or that the operating conditions of the plant will not change and render the original hazard control measures ineffective. This can only be done by constant attention to hazard control by supervision and management within the plant. Hazard control is a part of the day-to-day activity of plant production, just as is every other element of accident control. As premium size increases, insurance company engineers will make more frequent inspections, but in plants of 100 employees or less, these inspections will never be sufficiently frequent to maintain acceptable standards of hazard control.

There are other agencies that can be of assistance to the small plant in controlling hazards. State and federal labor departments are sources of information on guarding machinery and on other problems of hazard control. Many state labor departments or industrial commissions make periodic inspections of industrial plants. These inspections are for the purpose of determining whether a plant meets the minimum standards of safety required by law. These inspections are rather infrequent, the inspectors are, in some cases, not well-trained, and the requirements of state laws are not adequate for effective control.

Assistance concerning hazards of a chemical or health nature can

be secured from local or state departments of public health. Most health departments have trained industrial hygienists on their staffs.

Another group not to be overlooked are the manufacturers of safety equipment, although most such manufacturers are concerned with limited types of hazards or equipment. If the problem is one of hot metal splashes in a foundry, manufacturers of protective equipment for foundries can be of assistance. If the problem is one of eye injuries in a machine shop, any of the leading optical companies can help solve it.

Membership in the National Safety Council and in local safety councils is very helpful. The National Safety Council is the nation's leading source of safety information and publishes a considerable amount of technical material for practically every major industry.

Industrial technical and trade associations whose membership includes smaller plants are now conducting industry-wide safety programs for the benefit of their members. Concerning control of accident hazards, associations can prepare and distribute technical information concerning hazards which are common to the industry. Associations can develop standards of safe practice for their industries. A really progressive association can have a member of its safety staff visit and inspect plants within the industry and give assistance in planning and setting up continuing programs of hazard control.

Selective Employment and Placement. In methods of selecting and placing its employees, the small plant is again limited by its lack of specialized personnel. Where the large plant may have a well-trained personnel recruiting and testing department, the small plant may be limited to the owner-manager and a clerical assistant who must depend on

their personal judgement to decide whom to employ and what jobs employees should be placed on. Where the large plant may have an industrial physician to set up the physical requirements of jobs and to examine applicants for qualifications to fit these requirements, the small plant, in many cases, will not even require a pre-employment physical examination. But there are steps that a small plant can practicably take to ensure reasonable success in selecting employees and in placing these employees on jobs where they will work both safely and efficiently.

If workers are being employed who have experience in special skills or trades, past performance is a good measure of ability and possible success in the jobs to be filled. It is usually an easy matter for the person assigned to employment to communicate with former employers of such applicants to inquire of their past performance. Simple forms may be obtained to use in securing the desired information. The only requisite for use of this procedure is that employment needs be determined a short time in advance. This allows time for communication with previous employers; thus workers with good past records of safety and efficiency can be employed in preference to those with poor records. If employment needs cannot be determined in advance, workers can be employed on a temporary basis while communication is being made with former employers.

In employing workers having no special skill in the jobs to be filled, some other means of determining their qualifications must be determined. It is sometimes possible to temporarily place such workers in jobs easily within their abilities so that their aptitudes and performance can be observed. On the basis of actual observation, such ap-

plicants can be advanced to more skilled positions, or they may be released if their work is not satisfactory.

Once a decision has been made that applicants have the desired mental qualifications and aptitudes for positions to be filled, they should be given thorough physical examinations in terms of the jobs to be filled. Failure to determine the physical qualifications of workers results not only in high accident rates but also leads to costly damage claims by workers having old injuries, heart conditions, or other chronic maladies. Pre-employment physical examinations also prevent the spread of communicable diseases among present employees.

Adequate physical examinations can be had by any small plant at a reasonable cost. Any good physician who has a reasonable understanding of industrial job requirements can give applicants the necessary examinations. The compensation insurance carrier can usually recommend a qualified physician. It is better that only one physician be used, however, so that he can, over a period of time, come to know the specific job requirements of the plant. It is ideal, of course, to have the doctor make a study of each job type and prepare job specifications for each one. If this is not feasible, it will be helpful to have the doctor pay an occasional visit to the plant to become familiar with plant conditions and the type of work done.

The same measures used to place new employees in the proper jobs should also be taken in transferring old employees from one job to another. A recheck should be made of both mental and physical qualifications before placing a worker on a different job.

To ensure that workers maintain proper standards of health and of

physical qualifications, reexaminations should be given periodically to all employees. The frequency of such reexaminations will depend on the age of the employees and the type of work they do.

Outside assistance in the selection and placement of workers is rather limited. Some help in establishing general physical requirements for industrial workers can be obtained from local or state departments of public health and industrial hygiene. Where a major health hazard is involved, such agencies can give considerable assistance in maintaining the health of workers.

The best assistance obtainable in the recruitment and employment of workers is from consultants in personnel or in industrial psychology. Such consultants can, at a relatively moderate cost, make a study of each job classification in a plant, set up the requirements for each job, develop adequate methods of testing applicants for these requirements, and train someone in the plant to administer the tests. Once the system has been established and someone has been trained to administer it, the small plant can correctly select and place its workers almost as well as the large plant.

Safety Training. Training is necessary for each personnel level in the plant, each level requiring a different type of safety knowledge or information. Since the burden of carrying on this training will fall on the safety man - the member of the organization to whom safety is assigned - first consideration should be given to the means available for the safety man to acquire the training he needs to conduct a safety program properly.

In the average small plant, the person assigned to safety will not

have had previous experience in accident prevention. This person might be a personnel man, an engineer, a plant superintendent or general foreman, or perhaps the plant manager himself. Such laymen in the field of accident prevention should first seek some source of information which will enable them to reason logically just what accident prevention is and just what a safety program should consist of. Chapter II of this dissertation is such a source.

Having given himself a foundation in the basic principles of accident control, the safety man can then seek outside information and assistance. His insurance carrier, local safety council, or his industry association can give him help. The National Safety Council publishes a considerable amount of material that will be of assistance, and there are a few books on safety, including Heinrich's,* that the safety man can use to advantage.

After his program is underway and he has had sufficient experience with it to become familiar with the major problems of accident prevention, the safety man can then seek more formal training for himself. The colleges of almost every major city offer courses in industrial accident prevention. Some colleges offer adult evening classes which will be suitable for the safety man. Five times yearly the National Safety Council conducts courses in the basic fundamentals of industrial safety. For those who have taken the basic course, the Council periodically offers an advanced course covering a broad group of subjects relating to safety.

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*Industrial Accident Prevention, by H. W. Heinrich. (New York: McGraw-Hill Book Company, Inc., 1950.

In providing management with the policy-making information it needs, the safety man should first acquaint management with the basic elements of accident control. Using these elements as a foundation for the program, management and the safety man can determine which elements will be most effective in their plant and what general methods should be used to carry out these elements.

The safety man can keep management informed of the progress and the problems of the program by periodic written or oral reports. He can also invite management to participate in the safety meetings which are held with workers and foremen.

On the safety man also falls the responsibility of training supervisors. The chief types of training needed by supervisors are knowledge of accident prevention principles and techniques, knowledge of methods of instructing workers in safety, and information necessary for departmental policy-making. Policy-making information can best be given to supervisors through general safety meetings with the safety man and management. Principles of accident prevention and methods of instructing workers can be given to supervisors through general safety meetings, but organized training programs for supervisors are much more effective. To assist him in conducting organized supervisory training, the safety man can get appropriate material from the National Safety Council. Several excellent series of sound slidefilms have been prepared by the Council on safety supervision. In many areas, short-form safety courses for supervisors are conducted by colleges and by local safety organizations.

The importance of organized training for supervisors cannot be over-emphasized. Such training transforms the supervisor's attitude

toward accidents from something caused by careless acts of inferior workers to a realization that accidents have specific causes that can be controlled by the supervisor himself. Such training brings about a realization that accidents are caused by the same errors that cause inefficiency and poor production, and that accidents can be controlled by the same supervisory methods that are used to control efficiency and production.

Training of workers can best be carried on by supervisor, if of course, the supervisors have themselves already been trained. Most effective is specific, individual instruction of workers by their own immediate supervisors. Industrial supervisors continually train their workers in job methods, and it is a simple matter for them to expand this to include job safety training. They need only to analyze each job for safety as well as efficiency, and job safety will become an integral part of each operation.

Some general training is needed by workers, and this can be given in departmental meetings conducted by supervisors. Departmental meetings are satisfactory for instructing workers in general safety rules and for stressing to the worker the importance of safety. Posters and other literature are available to assist supervisors in conducting such meetings.

The plant safety man can help in training workers through departmental meetings and through occasional mass meetings of employees. Outside agencies, however, can be of little help in training workers except as sources of supply for training aids and safety literature. Workers can be trained effectively only by someone familiar with the

conditions and hazards which confront them. Industrial workers are not interested in generalized safety information brought in from the outside; they are concerned only with the specific hazards of their jobs.

Stimulation of Interest. The methods of stimulating and maintaining interest in safety are unlimited, and there are few of these methods which the small plant cannot employ as effectively as the large plant. Setting up an organized safety program is in itself a method of creating interest, a tangible demonstration to the workers that management is making effort to prevent injuries to its employees.

The plant safety man can stimulate the interest of management by citing the high cost of accidents; by comparing the plant's accident frequency rate with the rates of the other plants in the industry; or by pointing out the effect of accidents on employee relations and morale. The effects of accidents on morale in small plants are greater than in large plants because of the closer personal relationship among small groups of workers. There are instances in small plants where it has been necessary to shut down an entire plant until the workers recovered from the shock of a major accident.

The attitude of management toward safety will have a major effect on the interest which supervisors take. One way to secure the interest and active participation of supervisors is to organize safety committees to make inspections, to investigate accidents, to recommend policy to management and to assist in administering the safety program. Supervisors can also be appealed to through their sense of responsibility for their men, by setting up competition between departments, and by making accident prevention a definite, required part of every supervisor's job.

Workers can be appealed to through the instinct of self-preservation, the desire for personal gain, the desire for praise, fear of ridicule by fellow-workers, sense of loyalty and responsibility, and through competetive instinct. These motivating characteristics of human beings can be stimulated through an organized program of safety awards and contests, suggestion systems, poster and bulletin board displays, group meetings of workers, and by personal contact with management and supervisory personnel.

Employee participation is one of the most effective means of maintaining the interest of workers. Safety committees for workers have been set up in many plants; where separate committees are not desirable, several workers can be included as members of the general safety committee.

Caution should be used in conducting contests or in giving awards for suggestions and ideas. Such activities do not have a lasting effect and have to be frequently replaced with different and more elaborate contests and awards. In addition, ill-feeling is likely to develop unless definite rules are established for conducting these competitive activities.

All these things the small plant can do as well as the large plant. It may be somewhat limited in conducting inter-departmental competition because low exposure lengthens the time over which such competition must take place, but the small plant can enter into competition with other similar plants and can always challenge its own plant and departments to improve their past records.

The question of who can assist the small plant in stimulating

interest is a simple one. Industry associations, insurance carriers, local safety councils, Chambers of Commerce, the National Safety Council, or any interested public or private group can provide promotional material and can assist in conducting safety contests or in setting up safety awards and incentive plans. Many such groups regularly conduct safety contests and give appropriate awards to winners.

Industry associations can be of great help by publishing and distributing educational material and posters which illustrate specific problems within their industries. One of the biggest handicaps in using National Safety Council material is that their material is in some cases of a very general nature. The Council, of course, has a widely varying membership, and their material must of necessity in many cases be general. Individual small plants cannot afford to produce their own posters; but a group of small plants, through their industry association, can produce material which will apply to their operations and which will be many times more effective than that now being used.

Medical Care. The difference in medical facilities of large and small plants is beginning to be recognized as one cause of the differences in average frequency rates of large and small plants. Because of the extensive medical facilities which they maintain on their premises, large plants are able to treat most of their minor injuries in the plant without loss of time to the workers. In the average small plant, any injury requiring more than the simplest first-aid must be sent to an outside physician for treatment. In many cases small plant workers have to travel considerable distances to the doctor, frequently going back several times for observation and retreatment. These time-consuming visits may lead to

the loss of one or more days, and the injuries must be considered disabling. Some method must be determined, therefore, for providing adequate medical facilities in the smaller plants.

The minimum facilities for medical care are: 1) arrangements with a hospital or doctor for treatment of major injuries; 2) provision of space and equipment in the plant for first-aid treatment of minor injuries; and 3) provision of one or more trained attendants on each shift to administer first-aid.

The plant's compensation insurance carrier can assist in obtaining a doctor to treat major injuries. This doctor should also give the pre-employment physical examinations for new workers. The space and equipment needed for first-aid should be determined according to the number of employees in the plant, the hazards in the plant, and the area covered by the plant. The plant doctor or representatives of the Red Cross can assist in determining these needs. One or more first-aid attendants should be provided for each shift. First-aid will usually be only a part-time assignment in small plants, and clerks or stenographers whose work stations are centrally located serve well as first-aid attendants. Minimum training for these attendants should be the Red Cross standard first-aid course or equivalent. Attendants should work under written standing orders of the doctor.

Many small plants can economically go beyond the preceeding minimum requirements for medical care. Nurses can be employed to serve as plant nurses for a portion of their time and as stenographers or clerks the remainder of their time. Arrangements can be made to have a doctor make periodic visits to the plant.

The best plan yet developed for small plant medical service is the cooperative industrial health clinic. Several small plants located in a small area can join forces to organize a clinic. The cost of operating the clinic can be prorated among the member industries on a per capita basis, and the annual cost of operating a cooperative health clinic for 1000 workers has been estimated to be $15 per capita.[1] Personnel required to operate such a clinic properly are one full-time physician and three nurses. A clinic building can be set up at some central location, and a first-aid station should be maintained in each plant. The doctor and two of the nurses would usually remain in the clinic while the third nurse would make periodic visits to the first-aid stations of the participating plants.

The services of a health clinic go far beyond medical care for injured workers. Additional services would include pre-employment and periodic physical examinations, selective placement of workers by matching physical capacities of workers with physical demands of the job, and a program of preventive health maintenance.

Investigation and Recording. Whenever an injury occurs which involves workmen's compensation, the law requires that certain information about the injury be secured and reported to the plant's insurance carrier and to the state agency that administers the compensation laws. Such reports are designed to serve specific administrative purposes, and provide little or no information that will aid in preventing the recurrence of similar accidents.

Accident records, based on thorough investigations of accident causes, are intended to serve as working tools for the advancement of

accident prevention. If this aim is to be achieved, industry must go beyond the mere filling in of compensation insurance forms. Accidents must be thoroughly and promptly investigated, and sufficient records must be kept for accurate analysis of accident causes.

The methods of investigating and recording accidents available to small plants are the same as those available to large plants. However, since supervisors in small plants are less accustomed to complicated forms and reports, the system should be kept as simple as possible.

The supervisor of the injured person is the logical person to investigate and determine the causes of an accident. The safety man can, of course, give some assistance, but even in a small plant he is not as close to or as familiar with an accident situation as the supervisor of the injured person. Because of his wider knowledge of accident prevention, the safety man can be of real assistance in analyzing accident causes from reports made by supervisors.

Many large plants keep records of all accidents, regardless of whether an injury is incurred. Such extensive records might seem burdensome to small plant supervisors, so it is recommended that records be kept of injury accidents only.

A card-size injury record should be kept by the first-aid attendant of every accidental injury. This record should give identifying data about the injured person, a description of the injury, the disposition of the case, and a brief description (by the injured person) of the accident.

Supervisors should make an accident report on every injury accident giving a complete narrative description of the accident. In addition to

the identifying data, these accident reports should state what job the injured employee was doing, how he was injured, what he did unsafely, what unsafe condition existed, what safeguards might be used, and what steps were taken to prevent similar injuries. The costs of accidents should also be recorded in this report.

These two records should be sufficient for any plant of less than 100 employees. There is not a sufficient volume of injuries in a small plant to necessitate the use of monthly accident summaries or other elaborate statistical records. All that is really needed is a brief record of each injury and an accurate, complete record of each accident. From these can be obtained the necessary information for compensation claims and the facts needed for determining accident causes.

Not only will supervisors and safety men be able to determine the causes of individual accidents, but accident patterns or trends will develop over a period of time which will indicate certain weaknesses or needs in the overall prevention program.

Although accident investigations will for the most part have to be conducted by persons within the plant, some outside assistance can be obtained from insurance carriers and industry associations. Forms and procedural guides for keeping accident records can be obtained from these sources, and expert assistance can be obtained in analyzing accident causes.

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CHAPTER V

SETTING UP A SMALL PLANT PROGRAM

It has been stated repeatedly that every safety program should be individually designed for the specific plant in which it is to be used. The same basic elements are needed in every program, but the emphasis to be placed on each element and the methods used to carry out the elements will vary according to the needs of individual plants.

There are, however, certain principles which should be followed in organizing any program. It is also possible to outline safety organizations for plants of several sizes, and these outlines can be used as guides in setting up programs in other plants.

Organizing a Small Plant Program. The first step in organizing a safety program for any plant is to assign the responsibility for the program to one specific person. As is true of any activity, the program will surely flounder unless there is some one person responsible for planning and supervising the overall safety effort. Safety will of course be a part-time duty in most small plants.

Since the average small plant safety man will not have had previous accident prevention experience, his first step should be to equip himself with the fundamental knowledge he needs to direct his plant's program. The section on safety training in Chapter III suggests some methods by which he can do this.

The safety man should then work together with management and the supervisors to complete the organization of the program. At the outset it should be emphasized to the supervisors that the appointment of a

safety man does not in any way relieve them of their direct responsibility for accident prevention in their departments.

Before an effort is made to interest the workers or to train them in safe work habits, management, supervisors, and the safety man should give careful attention to those elements of accident control which are primarily the responsibility of management. The first of these is control of accident and health hazards. On the basis of past accident records and on analysis of the physical and mechanical hazards of the plant, all unsafe conditions should be brought under control. If there are hazards which cannot be adequately controlled, personal protective equipment should be provided for workers exposed to these hazards.

Steps should then be taken to provide medical facilities for treatment of employee injuries. Workers cannot be expected to report injuries unless provisions are made for treatment by trained personnel under clean, sanitary conditions.

Management is now ready to present the program to the workers. The first effort should be to stimulate the interest of the workers, and workers should be given an opportunity to ask questions and discuss the program. At the earliest possible time, they should be given an opportunity to participate in the program through memberships on committees or by submitting suggestions.

Once the program is under way, supervisors should begin to give their workers training in safe job methods. As the program progresses, supervisors will be able to include job safety training in their regular job methods training so that safety will become an integral part of every job.

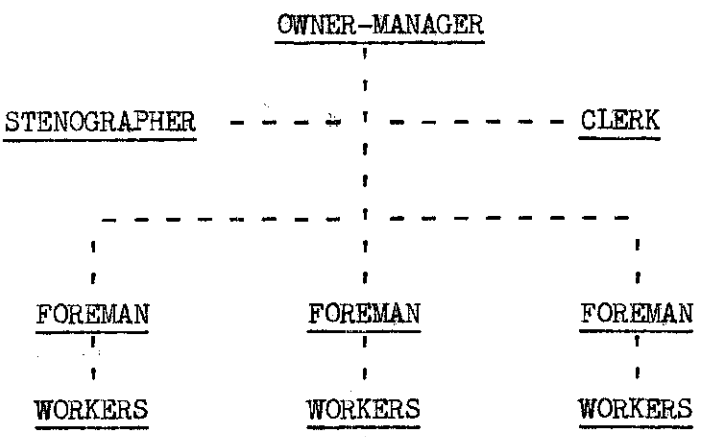
As the program develops further, the safety man and the supervisors can set up physical and mental requirements of jobs so that safety can be included in the plant's employment and placement procedures.

Definite procedures should of course be established for making safety inspections and for investigating accidents. These activities can be handled by the safety man, by supervisors, and by safety committees. The top executive of the plant should occasionally make safety inspections and should investigate all the more serious accidents.

The preceeding paragraphs give the major steps in organizing and initiating a safety program. There are many other activities which are important parts of any program, but these are chiefly the routine duties of the safety man. These include maintaining and analyzing accident records, distributing posters and other promotional literature, serving as secretary of plant safety committees, and securing technical information that will assist supervisors incontrolling the hazards of their departments. The safety man should also carry on a continual program of safety training for supervisors and of safety information for management.

Examples of Small Plant Safety Organizations. Typical safety organizations of plants of under 50 and of 50-100 employees can be outlined as examples of how safety programs can be set up in small plants. It should be remembered, of course, that such outlines can serve only as guides and cannot be adopted as packaged programs for any given plant.

For a Plant of Under 50 Employees. A plant of under 50 employees might have a table of organization something like this:



In setting up a safety organization in a plant with the personnel structure shown above, the owner-manager appears to be the only capable person in a position to direct an accident prevention program and to coordinate the safety activities of the foremen and workers with those of management. Since safety in a plant of this size will not require a great amount of time, the owner-manager should be able to assume the duties of safety man. The active participation of the top executive will, of course, have a stimulating effect on the foremen and workers.

The foremen should be directly responsible for controlling accidents in their departments. A general safety committee, composed of the three foremen and of one worker from each department, could be organized to advise the owner-manager on general safety policies. The owner-manager should act as chairman of the committee, and worker members of the committee should serve on a rotating basis. Regular meetings of the committee should be held at least every three months, with special meetings being held if needed.

To bring the physical and mechanical hazards of the plant within acceptable standards of control, the owner-manager and the casualty

insurance engineer should make a thorough initial inspection of the entire work area. To maintain effective control of accident and health hazards, foremen should make daily checks of their department areas; they should make monthly reports to the owner-manager on the general condition of their areas. The entire safety committee should make an inspection just prior to each quarterly committee meeting.

To ensure proper selection and placement of employees, a personnel expert might be called in to set up a simple, effective method of screening applicants. This should require an expenditure of only a few hundred dollars, a cost which would be repaid many times in safer and more efficient performance of workers. The personnel expert can set up job demands and can train the foremen, the clerk, and the owner-manager to match the qualifications of applicants with these job demands. The personnel expert can consult with the plant doctor and the foremen to establish the physical demands of the jobs.

The procedures set up for selection and placement need not be cumbersome nor should they require a great amount of red tape and paperwork. All that is needed is to acquaint those persons responsible for employment with the basic principles of selection and placement. All employment records can be maintained by the office clerk.

To equip himself with the knowledge he needs to direct his plant's safety activities, the owner-manager should make use of as many of the sources of training for safety men as he practicably can. As safety man he can give some training to safety committee members at their quarterly meetings. He should also give periodic training to his foremen in principles of accident prevention and in methods of instructing workers.

The foremen should give safety orientation and job training to all their workers. In their daily contacts with their men, the foremen can carry on a continual program of individual job safety instruction.

At least once monthly, the foremen should gather their employees together for a departmental safety meeting and for general safety training.

The efforts of management and the foremen to organize an effective accident prevention program will do much to create interest among the workers in the plant. Participation in safety committee meetings will increase the interest of workers; posters, safety demonstrations, films, and promotional literature can be effectively used to further stimulate interest. As an incentive to make an extra effort to work safely, a group award might be offered to all employees if the plant goes for a three-month period without a disabling injury.

The responsibility for first-aid treatment can be assigned to the clerk and stenographer. A first-aid station can be located in the plant office, and either the clerk or the stenographer will likely always be present during working hours to administer first-aid. The attendants should take a Red Cross first-aid course, and they should work under standing orders from a doctor. Definite arrangements should be made with a nearby doctor to treat all major injuries.

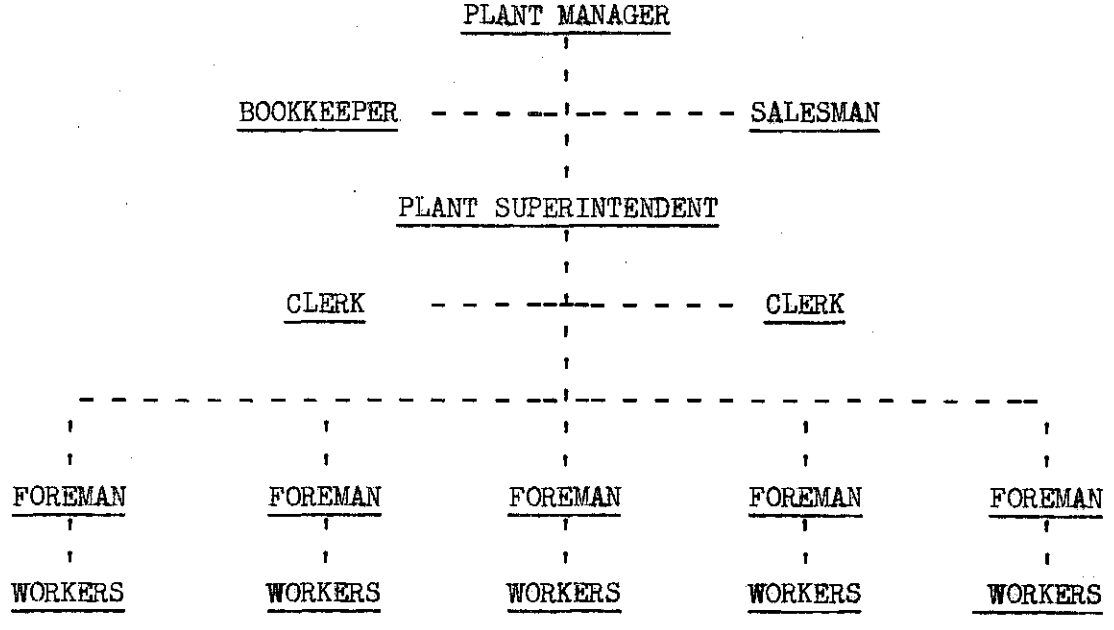
Every accident should be investigated by the foreman in whose department the accident takes place. In a plant of this size, it is likely that the foreman will observe almost every accident that occurs. The owner-manager should also make an investigation of major accidents, preferably in the company of the foreman. It may also be desirable, in cases of major injuries, to have the plant safety committee meet to

consider the causes of the accident and to assist in determining corrective action to be taken.

This safety organization should be adequate for an effective accident control program in the majority of plants in the under-50-employee size-group.

For a Plant of 50-100 Employees. The organization for a safety program in this size-group need not be very different from that for the under-50-employee plant. The major difference is in the assignment of responsibility for directing the program. Since there will be such similarity between safety organizations for the two sizes of plants, this section will touch only on those aspects which might be handled differently in a 50-100-employee plant.

A plant of this size-group might have a table of organization like this:



The manager of a plant of this size would most likely have too many other duties to assume full responsibility for directing the safety program. The plant superintendent then becomes the logical person in the organization to act as safety man. He is the connecting link between the supervisory group and the top executive of the plant; he is in an ideal position to coordinate their activities. The superintendent is also of sufficient rank in the organization to impress foremen and workers with the importance attached to safety by management.

The responsibilities of foremen should be the same as those set forth previously. The same type of safety committee should function well in a plant of this size, except that meetings would need to be held more frequently, probably once monthly. The superintendent of the plant should act as chairman of the committee, and action taken by the committee should be in the form of recommendations to the plant manager. The plant manager should attend meetings periodically but should have no voice in the action taken by the committee.

Control of hazards, selection and placement of workers, and training and interest can be handled just as in plants of under 50 employees. In the 50-100-employee plant, however, the superintendent will seek the training and information recommended in Chapter III for the safety man of a plant. As safety man, the superintendent will have to make reports and give information to the plant manager, and he will have to take whatever steps might be necessary to maintain the interest of the plant manager.

The clerks working under the superintendent can act as first-aid attendants. Investigation and recording of accidents can be dealt with just as was recommended previously.

It is easily seen from the small plant safety programs proposed here that any plant can set up an effective accident control program within its existing organizational framework. The assistance of a safety expert would be extremely helpful, but an expert is not necessarily essential to a successful program. It is essential, however, that the program be built around a framework of all the elements of accident control. The program must be complete and well-balanced. It cannot be based on one or two elements which are popularly thought to be the only necessary components of accident control.

CHAPTER VI

PROMOTING SAFETY AMONG SMALL PLANTS

With large as well as with small plants, the major task of the leaders of the safety movement has been to convince management that accident prevention is a vitally necessary component of every industrial operation. This promotional job has been most successful when safety was presented on an economic rather than a humanitarian basis. Every management is aware of the hardship and suffering brought on by employee injuries, but this humanitairan element does not always provide sufficient motivation to cause management to take the action necessary to prevent accidents.

Large plants are now sufficiently aware of the cost of accidents to be rather well convinced of the need for accident prevention. Their accounting systems are sufficiently accurate to show the tremendous uninsured costs of accidents, costs which too often are unrecognized in the smaller plants of the nation. In the majority of small plants, all uninsured or indirect costs are either absorbed into production costs or are all grouped into one overhead account where no individual costs can be identified.

The problem then becomes one of developing an effective method of showing the cost of accidents to small plant managements. One method of doing this is to show the amount of sales necessary to pay the cost of accidents in a given plant. The net earnings of the average industrial operation is about five per cent. In a 100-employee plant paying a manual rate of $1.00 per $100 payroll and having an average labor

rate of $1.25 per hour, the cost of workmen's compensation insurance would be $2500. Using the four-to-one ratio of indirect to direct expense, the total cost of accidents in such a plant would be $12,500 a year. At a net earnings rate of five per cent, the total annual sales required to pay for accidents would be $250,000. In a more hazardous plant having a manual rate of $2.00 per $100 payroll, $500,000 of each year's sales would be required to pay for accidents in a 100-employee plant.

These cost figures are startling, but are still rather general and not likely to make a great impression on the average small plant manager. Something more effective is needed.

Profit and competition are the major driving forces of industry. Nothing has a greater effect on the management of an industrial plant than to see a neighboring plant operating more profitably as a result of some progressive step it has taken. It would be well to take advantage of this competitive factor in selling safety.

A successful program in one small plant in every major industrial community of the nation would be the best possible means of promoting safety. This may seem difficult to achieve, but there are already in existence in every major city one or more organizations that could easily carry on a small plant program.

There are about 60 local safety councils in the country that have full-time personnel on their staffs. Each of these local councils can find in its industrial community a small plant which would cooperate with the council in carrying on a model small plant program for a period of time sufficient to make an impression on other small plants in the

area. If every local council would undertake such a project, it would soon have many small plants seeking its assistance in setting up their own programs.

There are also in the nation about 50 chapters of the American Society of Safety Engineers. Each of these chapters could easily carry on a small plant program in its community.

The only significant weakness in setting up model small plant programs on a community basis is that plants in some industries might feel that their problems were different from those of the industries of the model plants. To prevent this feeling from developing, the associations of every major industry should set up programs in one or more small plants in their particular industry.

Industry associations are in excellent positions to assist their members, small or large, in organizing and conducting safety activities. One of the biggest obstacles faced by public safety agencies is that they are looked on as outsiders when they attempt to persuade the management of a plant to undertake some safety activities. An association, however, is an insider having the full confidence of its members.

Those associations that have undertaken to promote accident prevention in their industries have been very successful. The Portland Cement Association, for instance, has reduced accident rates among its members by 83% over a period of 25 years.[1] The accident frequency rate of non-member plants in the industry is 11 times greater than that of member plants taking part in the association's program.[2]

Local safety councils, chapters of ASSE, and industry associations can contribute significantly to the promotion of safety among small

plants. These organizations have intimate knowledge of conditions within their community or industry, and they have the confidence and respect of key members of small plant managements in their respective areas. These organizations are more likely to be successful in attacking the small plant problem than are any other public or private safety agencies.

Because of the indifferent attitude of small plant management toward safety, the task of promoting safety among small plants is truly a challenging one. But it is a challenge which should not be avoided by the organizations best able to meet it. If these organizations will establish model programs to give small plant management concrete evidence of the benefits of accident prevention, the cause of safety will be greatly furthered in the small industrial plants of the nation.

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APPENDIX

APPENDIX

SMALL PLANT SAFETY SURVEY

NOTE: This survey is not concerned with the identity of individual plants or companies. Please answer ALL questions.

1. Type of industry and/or major product _____

2. Average number of factory employees in 1950 _____

3. Number of disabling injuries in 1950 _____

4. Is someone in your plant regularly assigned to safety? Yes___ No____
   If yes, is this person a trained safety man? Yes_____ No_____
   What part of this person's time is spent on safety? Part____ All____

5. Is there a safety committee in your plant? Yes_____ No_____

6. Are regular inspections made to detect safety hazards? Yes___ No___

7. Is safety training provided for your foremen? Yes_____ No_____

8. Is safety training provided for your workers? Yes_____ No_____

9. What methods are used to create interest in safety? Posters_____
   Contests_____ Awards_____ Suggestion system_____ Other_____

10. Who treats minor injuries in your plant? Part-time doctor_____
    Part-time nurse_____ Trained first-aid attendant_____ No one____

11. Are pre-employment physical examinations given to new workers?
    Yes_____ No_____

12. By whom are accidents investigated? No one_____ Safety man_____
    Safety committee_____ Executives_____ Insurance man_____
    Foremen_____